Express Mail Label No.: EF371229510US
Date of Deposit: April 6, 2001

Attorney Docket No. 17564-145

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First-Named Inventor:	Tang, Jie
Assignee:	Fry's Metals, Inc.
For:	APPARATUS AND METHOD FOR MAKING UNIFORMLY SIZED AND SHAPED SHPERES
Original Patent No.:	5,891,212
Original Issue Date:	April 6, 1999

Box REISSUE
Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-identified reissue application, please amend the claims as follows.

Please amend claims 1, 15 and 16 as follows:

1. (Amended) A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least one heat transfer medium, the

heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment;

[applying a charge to] breaking the stream of material [as the stream exits the orifice and breaks] up into a plurality of uniform sized and shaped liquid spheres, and

[passing the charged liquid spheres through an electric field to deflect the liquid spheres, and]

allowing the liquid spheres to pass through the heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

15. (Amended) The method of claim [1] 29, in which the deflection means comprises two spatially separated surfaces and comprising generating the electrical field between the two surfaces to deflect the descending spheres.

16. (Amended) A method for forming uniform sized and shaped spheres comprising the steps of:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled temperature solidification environment;

[applying a charge to] breaking the stream of material [as the stream exits the orifice and breaks] up into a plurality of uniform sized and shaped liquid spheres; and

[passing the charged liquid spheres through an electric field to deflect liquid the spheres; and]

allowing the spheres to pass through first and second media in an enclosed controlled temperature solidification environment to cool and solidify the spheres;

the enclosed controlled temperature solidification environment including a first, gaseous environment through which the charged spheres are passed, the first, gaseous environment containing the first medium which comprises a spray of cooling fluid, liquefied gas or halocarbon, the first medium evaporating in the enclosed controlled temperature solidification environment and absorbing the heat of fusion from the spheres;

the enclosed controlled temperature solidification environment also including a second, liquid environment through which the spheres pass after passing through the first, gaseous environment, the second, liquid environment containing the second medium which comprises a supply of a liquid material, the second medium cushioning the spheres before the spheres contact a bottom of the enclosed controlled temperature solidification environment.

Please add claims 29-31 as follows.

29. (New) The method of claim 1, further comprising steps of:
applying a charge to the stream of material as the stream exits the orifice; and
passing the charged liquid spheres through an electric field to deflect the liquid spheres.

30. (New) The method of claim 16, further comprising steps of:
applying a charge to the stream of material as the stream exits the orifice; and
passing the charged liquid spheres through an electric field to deflect the liquid spheres.

31. (New) A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

applying a pressure to low viscosity liquid material contained in a crucible, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least one

heat transfer medium, the heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment;

allowing the liquid spheres to pass through the heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

Remarks and Statement Pursuant to 37 C.F.R.§1.173(c)

Prior to examination, Applicant requests that the above-identified reissue application be amended as indicated herein. With these amendments, claims 1-31 are pending in the applications, with claims 1, 16 and 31 being in independent format. For the Examiner's convenience, an Appendix containing the pending claims is included with this amendment.

Each of claims 1 and 16 has been amended to broaden the scope of these claims by more broadly reciting how the stream of material is broken into spheres and to remove the step of passing the spheres through an electric field. These amendments merely remove unnecessary limitations from the claims, and accordingly, support for these amendments is provided in the original disclosure.

Claims 29 and 30 respectively depend from claims 1 and 16 and include the limitations that have been deleted from original claims 1 and 16. Accordingly, support for these claims is provided in the original disclosure.

Claim 31 is a new independent claim that is similar to claim 1 although recited more broadly with the removal of unnecessary limitations. Because of the similarity to original claim 1, support for claim 31 is provided in the original disclosure.

The present reissue application is believed to be in allowable condition, and a notice to that effect is respectfully requested. If the Examiner has any questions, he is invited to contact the undersigned at the number provided below.

Respectfully submitted,

Thomas M. Sullivan
Registration No. 39,392
Mintz, Levin, Cohn, Ferris
Glovsky and Popeo, P.C.
One Financial Center
Boston, MA 02111
T: 617/348-1661
Attorneys for Applicant

Date: 4/6/07

APPENDIX A

CLAIMS AS PENDING

1. (Amended) A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least one heat transfer medium, the heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres, and

allowing the liquid spheres to pass through the heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

2. The method of claim 1, in which the enclosed con-trolled temperature solidification environment includes a first, gaseous environment through which the charged spheres are passed, the first, gaseous environment containing the first heat transfer medium which comprises a spray of cooling fluid, liquefied gas or halo-carbon which evaporates in the enclosed controlled temperature solidification environment and which absorbs the heat of fusion from the spheres.

3. The method of claim 2, in which the enclosed con-trolled temperature solidification environment includes a second, liquid environment through which the spheres pass after passing through the first, gaseous environment; the second, liquid environment containing a second heat transfer medium which comprises a supply of a liquid material.

4. The method of claim 3, comprising passing the spheres through the second, liquid environment to remove heat from the spheres and to cushion the spheres before the spheres contact a bottom of the enclosed controlled temperature solidification environment.

5. The method of claim 3, comprising varying a distance defined between a point at which the stream breaks into the spheres and a point at which the spheres contact the second or liquid environment.

6. The method of claim 1, further including the step of visually monitoring the stream of low viscosity liquid material as the stream breaks into spheres to provide information on the diameter and shape of the spheres and the stability of the stream.

7. The method of claim 1, comprising collecting the solidified spheres in a funnel-shaped bottom of the enclosed controlled temperature solidification environment.

8. The method of claim 1, in which the solid spheres have a diameter ranging from about 12 to about 1000 microns.

9. The method of claim 1, in which the spheres pass through the enclosed controlled temperature solidification environment for about 0.5 to about 1.5 seconds prior to contacting a bottom of the enclosed controlled temperature solidification environment.

10. The method of claim 1, comprising applying the minute, periodic disturbance to the low viscosity liquid material by a piezoelectric actuator.

11. The method of claim 10, in which the piezoelectric actuator comprises a stack of piezoelectric crystals mounted on a top portion of the crucible.

12. The method of claim 1, comprising applying the minute periodic disturbance to the low viscosity liquid material by an electromechanical transducer mounted on a top portion of the crucible.

13. The method of claim 1, comprising applying the minute periodic disturbance with a nozzle that has a fixed aspect ratio defining the orifice.

14. The method of claim 1, comprising applying a substantially constant positive pressure to the low viscosity liquid material to force the low viscosity liquid material out through the orifice in a steady laminar stream.

15. (Amended) The method of claim 29, in which the deflection means comprises two spatially separated surfaces and comprising generating the electrical field between the two surfaces to deflect the descending spheres.

16. (Amended) A method for forming uniform sized and shaped spheres comprising the stops of:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed con-trolled temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres; and

allowing the spheres to pass through first and second media in an enclosed controlled temperature solidification environment to cool and solidify the spheres;

the enclosed controlled temperature solidification environment including a first, gaseous environment through which the charged spheres are passed, the first, gaseous environment containing the first medium which comprises a spray of cooling fluid, liquefied gas or halo-carbon, the first medium evaporating in the enclosed controlled temperature solidification environment and absorbing the heat of fusion from the spheres;

the enclosed controlled temperature solidification environment also including a second, liquid environment through which the spheres pass after passing through the first, gaseous environment, the second, liquid environment containing the second medium which comprises a supply of a liquid material, the second medium cushioning the spheres before the spheres contact a bottom of the enclosed controlled temperature solidification environment.

17. The method of claim 16, further including the step of visually monitoring the stream of low viscosity liquid material as the stream breaks into spheres to provide information on the diameter and shape of the spheres and the stability of the stream.

18. The method of claim 16, comprising collecting the solidified spheres in a funnel-shaped bottom of the enclosed controlled temperature solidification environment.

19. The method of claim 16, in which the spheres have a diameter ranging from about 12 to about 1000 microns.

20. The method of claim 16, in which the spheres pass through the enclosed controlled temperature solidification environment for about 0.5 to about 1.5 seconds prior to contacting a bottom of the enclosed controlled temperature solidification environment.

21. The method of claim 16, in which the enclosed low temperature solidification environment is at a temperature of less than about 0° C.

22. The method of claim 16, comprising varying a distance defined between a point at which the stream breaks into the spheres and a point at which the spheres contact the second, liquid environment.

23. The method of claim 16, comprising applying the minute periodic disturbance to the low viscosity liquid material by a piezoelectric actuator.

24. The method of claim 23, in which the piezoelectric actuator comprises a stack of piezoelectric crystals mounted on a top portion of the crucible.

25. The method of claim 16, comprising applying the minute periodic disturbance to the low viscosity liquid material by an electromechanical transducer mounted on a top portion of the crucible.

26. The method of claim 16, comprising applying the minute periodic disturbance with a nozzle that has a fixed aspect ratio defining the orifice.

27. The method of claim 16, comprising applying a substantially constant positive pressure to the low viscosity liquid material to force the low viscosity liquid material out through the orifice in a steady laminar stream.

28. The method of claim 16, in which the deflection means comprises two spatially separated surfaces and comprising generating the electrical field between the two surfaces to deflect the descending spheres.

29. (New) The method of claim 1, further comprising steps of:
applying a charge to the stream of material as the stream exits the orifice; and
passing the charged liquid spheres through an electric field to deflect the liquid spheres.

30. (New) The method of claim 16, further comprising steps of:
applying a charge to the stream of material as the stream exits the orifice; and
passing the charged liquid spheres through an electric field to deflect the liquid spheres.

31. (New) A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

applying a pressure to low viscosity liquid material contained in a crucible, the pressure

forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least one heat transfer medium, the heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment; and

allowing the liquid spheres to pass through the heat transfer medium in the enclosed

controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.